



SUBSTITUTE SPECIFICATION

DIGITAL CORDLESS TELEPHONE

Field of the Invention

The present invention relates to a digital cordless telephone. More specifically, the present invention relates to a digital cordless telephone which is provided with a transceiver mode that allows a direct communication between cordless hand sets of the PHS (Personal Handy System).

Description of the Related Art

The PHS is stipulated to communicate in conformity with the RCR STD-28, which is the standard (ARIB Standard) of the second-generation cordless telephone system determined by the Association of Radio Industries and Business of Japan. Clause 2.10 of the standard states, regarding the 'direct communication between cordless hand sets', the effect of the provision of the function that "a mobile station of this system shall be capable of a direct and mutual communication between mobile stations without intervention of a base station (direct communication between cordless hand sets) as an auxiliary communication means in an area where the communications with intervention of the base station are impossible, and so forth".

The direct communication between cordless hand sets in the above standard will approve a use as a transceiver between PHS cordless hand sets that are registered in advance with the parent equipment within the permissible scope of the Wireless

Telegraphy Act (the exceptive clause of the fourth article, the Wireless Telegraphy Act). However, it is very rare that a PHS owner practices of a PHS handset use as the transceiver. The reason is that there are notable inconveniences, such that the
5 cordless hand sets have to be registered in advance with the parent equipment, or with fellow cordless hand sets. In addition, power consumption in the waiting state by the transceiver is comparably high; there is also a demand that the equipment is desirably put in the waiting state only when it
10 is used in the transceiver mode.

A conventional example to solve the above problem is disclosed in JP-A No.339768/2001, which involves a disadvantage in that, since the system deals with unspecified speakers, the system will reveal an inter-cordless hand set group calling code
15 and extension number to the other party with whom the group members do not want to communicate. Also, the example still has the problem of power consumption in the waiting state. The Publication JP-A no.285934/2001 premises that the cordless hand sets are registered with the parent equipment in advance;
20 therefore, the above problem regarding the registration of the cordless hand sets is not basically solved. In this regard, the JP-A No.11-88960, JP-A No.11-88952, and JP-A No.10-155177 are the same.

The Publication JP-A No.10-200955 discloses the

invention in Claim 1 thereof, "a mobile telephone with an automatic communication switching function that receives the service from a communication enterprise, which is specialized by providing a function that transmits a control signal from
5 a transmitting-side telephone, and sets the same frequency as that of the transmitting-side telephone to a receiving-side telephone, and an automatic communication switching function capable of detecting the response of the receiving-side telephone to a test radio wave from the transmitting-side
10 telephone, and capable of switching the communication into the transceiver communication in a communication between mobile telephones". Although this invention includes an inconvenience such as 'registering the cordless hand sets with the parent equipment' and so forth, this is the same as the
15 present invention described hereunder, in view of the system that switches into the transceiver communication by using a public telephone line. However, the system is to properly use 'two different tone signals' and switch into the transceiver communication. Since the system uses the tone signals during
20 a communication, the system involves an inconvenience such that the communication has to be disconnected temporarily and a second communication has to be established. The other data communications in the PHS also involve similar inconveniences.

In this manner, when a transceiver communication is

performed between cordless hand sets of the PHS, it involves the inconvenience that the cordless hand sets must be registered in advance, and the requirement to achieve the reduction of power consumption in the waiting state. Also, in the system
5 that switches into the transceiver communication by using a public telephone line, an easy and simplified system in conformity with the sequence of the PHS is demanded. Further, the system bears a social demand not to leak secret information of the communication to unspecified speakers.

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Summary of the Invention

In order to solve the above problems, the present invention adopts a system that sets the group identification code for direct communication between personal stations and an
15 extension number in the public communication system conforming to the ARIB standard, in a normal communication between specified speakers. The system employs a called party subaddress information element and so forth in the call setting messages, for transferring information such as the group
20 identification code for direct communication between personal stations, and so forth. The present invention adopts a system that conforms to the sequence of the PHS, and switches the waiting mode according to the contents of only the 'control signal' (CC control signal in the present invention).

Therefore, the system of the present invention does not involve the inconveniences that are inherent to the conventional systems in that the communication has to be disconnected temporarily and a second communication has to be established, in order to carry out the normal (original) communication in the conventional systems.

Brief Description of the Drawings

Fig. 1 is a sequence chart until a direct communication is started between cordless hand sets in the embodiment according to the present invention;

Fig. 2 is a flow chart until a receiving party determines to change the waiting mode, in the embodiment according to the present invention; and

Fig. 3 is a chart illustrating the configuration of the called party subaddress information element, based on the embodiment of the present invention.

Detailed Description of the Preferred Embodiments

The embodiment of the present invention will now be described in detail. The embodiment of the present invention adopts a system that sets the group identification code for direct communication between personal stations and an extension number in the public communication system conforming to the

above standard, in a normal communication between specified speakers. That is, the system of this embodiment transmits necessary information to the other party by means of a public telephone network, and lets the other party prepare for
5 receiving.

Fig. 1 illustrates a sequence until a direct communication between cordless hand sets is started, in this embodiment. In Fig. 1, the left side shows a transmitter PS1 (Personal Station 1), which is linked with a cell station CS1,
10 and the right side shows a receiver PS2 (Personal Station 2), which is linked with a cell station CS2. When the transmitter PS1 calls the receiver PS2 through a public telephone network 101, in order to make a conversation with the receiver PS2 in the transceiver mode, the sequence first executes a CC (Call
15 Control) call setting S103, which is unique to the present invention, to the cell station CS1 that is linked with the transmitter PS1. The CC setup S103 signifies the called party subaddress information, etc., which is unique to the present invention as described hereinafter, which includes information
20 for requesting to change the waiting mode, and so forth.

The calling by the transmitter PS1 calls the receiver PS2, as a calling S104 from the cell station CS2 to the receiver PS2. As the receiver PS2 responds to this paging (call-in) S104, the information is answered to the cell station CS2 as a RT paging

response S105. Here, RT is an abbreviation for Radio Frequency
Transmission Management, which signifies the processes of the
setting, maintaining, switching, disconnecting and recovering
of the network connection in the wireless interval interface
5 of the second-generation cordless telephone system, and the
location registration and authentication of the personal
stations. Receiving the response from the receiver PS2, the
cell station CS2 transmits to the receiver PS2 a CC setup (call
setting) S106 corresponding to the CC setup S103 of the
10 transmitter PS1.

Receiving the CC setup S106, the receiver PS2 normally
stores in the internal memory of its own PHS the information
that the transmitter PS1 transmitted, such as the waiting mode
change and so forth. This information includes the transmitter
15 telephone number, an identifier for requesting to change the
waiting mode, a designated waiting mode, a group identification
code for direct communication between personal stations, a PS
station number, and so forth. The information of the other
party is displayed on the display unit as needed.

20 Further, the conventional example designates the
extension number that is used in the transceiver mode by
utilizing the password contained in the transfer message.
However, the present embodiment directly designates the
extension number as the PS station number (hereunder, referred

to as the extension number).

Whether or not to accept the transmitter's request to change the waiting mode and so forth is determined in principle by the receiver on the basis of the display (S107 in Fig. 1).

5 Fig. 2 illustrates a flow chart of a process until the receiver determines to change the waiting mode. In Fig. 2, when the CC setup (S106) in Fig. 1 is received (S201), this embodiment is made capable of determining whether to automatically change the waiting mode (S202). If the step automatically changes the
10 waiting mode (Y at S202), it is next selected whether or not to compare with the telephone directory (S203). Here, the telephone directory signifies a certain data stored in the internal memory, etc., of the PHS, and a telephone book is one example thereof.

15 The objects of comparison are the information to thereby identify the relevant transmitter, such as the names and telephone numbers of acquaintances on the list of the telephone directory, and other electronic mail addresses, etc. If the relevant party is not present on (in) the telephone directory
20 (N at S204), since the waiting mode change is automatically selected already, the CC disconnection is made without CC call proceeding (acceptance) (S205). In terms of the transceiver, this means disconnecting the line automatically in response to the calling from the other party. Executing this disconnection

(S205) before ringing a receiving melody and the like will make it possible to prevent harassments, etc.

If the comparison with the telephone directory is not executed (N at S203), and if the relevant party is present on
5 the telephone directory (Y at S204), the waiting mode is automatically changed (S206). Thereafter, to inform the transmitter of accepting the CC setup, a CC call proceeding is transmitted (S207).

In this embodiment, only when the waiting mode is not
10 automatically changed (N at S202), the information of the transmitter's number and the like are to be displayed on the display unit of the PHS (S209); however, the display may be made independently. If the setting of the automatic mode change is selected, and if the relevant transmitter is present on the
15 telephone directory, the information is also given on the display unit (S210).

If the waiting mode is not automatically changed (N at S202), the judgment by the receiver is thereafter executed (S212). This judgment will be made with reference to the above
20 information that is displayed on the display unit. As a result, if the waiting mode is changed (Y at S213), the waiting mode is changed in practice (S206), and then the CC call proceeding is transmitted (S207). Further, if the waiting mode is not changed (N at S213), the CC disconnection is made without CC

call proceeding (S205).

Returning to Fig. 1, the sequence of the direct communication between the cordless hand sets will be disclosed, when the change of the waiting mode and so forth are executed (S107). In Fig. 1, the receiver transmits the CC call proceeding (S108) for notifying the transmitter that the changes of the waiting mode and so forth have been executed. Thereafter, the receiving side terminates the communication with the cell station CS2 so as to execute the change into the waiting mode that the transmitter desired. This termination is executed by the notification of the CC release (S110) from the cell station CS2, which responds to the CC disconnect (S109) from the receiver PS2, and the notification of completion of the CC release (S111) from the receiver PS2, which responds to the former notification.

The CC call proceeding (S108) from the receiver PS2 is transmitted to the transmitter PS1 through the cell station CS1. Receiving this information, the transmitter PS1 normally changes its own mode into the same waiting mode as the transmitter requested the receiver. Thereafter, the transmitter PS1 terminates the communication with the cell station CS1. This termination is executed by the notification of the CC release (S114) from the cell station CS1, which responds to the CC disconnect (S113) from the transmitter PS1,

and the notification of the CC release completion (S115) from the transmitter PS1, which responds to the former notification.

According to the standard norm, the inter-cordless hand set group calling code is notified to the other party as the transfer message. However, the embodiment of the invention
5 adopts the system that employs the called party subaddress information element and so forth, as will be described later, in the CC setup (S103), as to the information that is required for the transition to the transceiver mode, such as the
10 inter-cordless hand set group calling code, and so forth. Therefore, this embodiment does not use the transfer message for transferring the inter-cordless hand set group calling code and so forth.

Thus, according to the above sequence, the cordless hand
15 sets of both the transmitter PS1 and the receiver PS2 were transferred to the transceiver mode on a public telephone network. Thereafter, the direct communication between the cordless hand sets (102) is made by means of the message for the direct communication between the cordless hand sets. The
20 call-out in the transceiver mode may be made from either side of the transmitter PS1 and the receiver PS2; however, this embodiment discloses the system to make the call-out from the transmitter PS1. When the transmitter PS1 calls the receiver PS2, the inter-cordless hand set group calling code and the

extension number of the receiver PS2 are designated, and the call message is directly transmitted without intervention of the cell stations as the message for the direct communication between the child equipments, on the basis of the CC call proceeding (S112), and thus, the direct communication between the cordless hand sets is carried out (S116). The receiver PS2 compares the group identification code for direct communication between personal stations and the extension number that are contained in the call message with the data contained in its own internal memory. If the result conforms, the receiver PS2 transmits a synchronization message as the message for the direct communication between the personal stations (S117). In the same manner, the transmitter PS1 transmits the synchronous message as the message for the direct communication between the child equipments (S118), whereby both the transmissions are established.

Upon reaching this stage, as the receiver PS2 who received the call unhooks the PHS to make the conversation (S119), the receiver PS2 transmits a connect message (S120) as the message for the direct communication between the personal stations, in order to notify the transmitter PS1 that transmission has started.

Receiving the connect message, the transmitter PS1 transmits a TCH (Transfer Channel) idle burst to the receiver PS2, and

waits for the receiver PS2 to reach the TCH starting state (steady state) (S121). Also, the receiver PS2 transmits the TCH idle burst to the transmitter PS1, and waits for the transmitter PS1 to reach the TCH starting state (steady state) (S122). At this stage, both reach the TCH starting state in the end, which allows the communication by the transceiver mode (S123).

The conventional example transmits the transfer message for transferring the group identification code for direct communication between personal stations before the alerting message, and automatically executes the setting of the receiving-side cordless hand set, by such a contrivance that utilizes the password (the password itself is to conceal the group identification code for direct communication between personal stations) contained in the transfer message as the extension number. In contrast to this, the embodiment of the present invention adopts the system that automatically executes the change of the waiting mode of the receiving-side cordless hand set and so forth during a normal communication through a public telephone network, and the information of the system is not the transfer message that is normally used, but the called party subaddress information element, etc., contained in the CC call setup (S103 in Fig. 1) in the public communication.

Fig. 3 illustrates the configuration of the called party

subaddress information element according to the embodiment.
The called party subaddress is used for identifying the
subaddress on the receiving side. Here, the subaddress
signifies the numbers that are added on after the telephone
5 number to make a call directly get to an extension of a private
telephone switchboard (PBX) and so forth. The called party
subaddress information element in itself is optional, and has
a high degree of freedom in format, but it is restricted to 23
octets maximum. In Fig. 3, the first octet is composed of an
10 extended bit of the 8th bit, and an information element
identifier (7 bits) not more than the 8th bit. In this case,
the information element identifier is the called party
subaddress (1110001). The second octet is an information
element content length, and is the called party subaddress
15 content length in this case. The third octet is composed of
an extended bit of the 8th bit, a subaddress type from the 7th
through the 5th bit, a display as to whether the number of the
4th bit address signal is even or odd, and a reserved area from
the 3rd through the 1st bit. Here, a user unique subaddress (101)
20 is adopted as the subaddress type. This is because the
subaddress information more than on the fourth octet is composed
with a unique configuration in the embodiment of this invention.

The fourth octet is a waiting mode change request
identifier that is a unique configuration in the embodiment of

this invention. This information element identifier indicates that this message shows the content of the transmitter PS1 demanding the waiting mode change to the receiver PS2. The fifth octet is an area for designating the waiting mode, and
5 the content is shown in the following table.

	Bit	mode
	00000000	only for registration (mode change unavailable)
10	00000001	public
	00000010	private
	00000011	transceiver (direct communication between cordless hand sets)
	00000100	public + private
15	00000101	public + transceiver
	00000110	private + transceiver
	00000111	public + private + transceiver

Here, 'public' signifies a communication using a public
20 cell station, 'private' signifies a communication using a parent equipment of a home digital cordless system, or a cell station of a company or business cordless system, and 'transceiver' signifies a communication by the direct communication between cordless hand sets by the PHS. The

waiting mode designation '00000000' is for registering the group identification code for direct communication between personal stations and so forth, but not executing the waiting mode change. This is effective in the case of completing only
5 the setting before using the transceiver mode in practice.

The sixth through ninth octets are allocated for the group identification code for direct communication between personal stations composed of 29 bits. The group identification code for direct communication between personal stations should
10 originally be transmitted to the other party as a transfer message with the password attached, as the standard norm or in the conventional examples. However, the embodiment of this invention adopts the configuration that is transmitted to the other party as the subaddress information of the called party
15 subaddress information element. The tenth through eleventh octets are allocated for the PS station number, which is used as the extension number. This embodiment employs the public telephone network (101), and is able to fix this PS station number comparably freely, which is advantageous.

20 The embodiment of this invention has disclosed the system using the called party subaddress information element. However, the information element identifiers contain a calling party subaddress having a format which is similar to the called party subaddress. Accordingly, using the calling party

subaddress will make up the same configuration as the called party subaddress according to the embodiment of this invention.

According to the embodiment of the invention as described above, the system is adopted which utilizes a public telephone
5 network to send necessary information to the other party, and lets the other party prepare for receiving. Therefore, if the mode is set to be changeable in advance, it will allow using the transceiver easily with the PHS of a specified person. Since the system uses a public telephone network, the
10 interventions of unspecified persons can be prevented so as to secure the privacy of communications. In addition, the waiting by the transceiver becomes unnecessary, which reduces the power consumption during waiting. Besides, the system saves a troublesome registration operation that is regarded as
15 necessary with the transceiver of the PHS.

The conventional 'system that switches into the transceiver communication by using a public telephone line' is the system that properly uses the 'two different tone signals' to switch into the transceiver communication. The system of
20 the present invention conforms to the sequence of the PHS, and switches into the transceiver communication according to only the contents of the 'control signal' (CC control signal in this invention). Thus, the communication systems of both are different. Therefore, the conventional system is not able to

secure the privacy of communications in the transceiver communication, and is not able to reduce the power consumption during waiting. However, the present invention is able to satisfy these requirements sufficiently. Moreover, the
5 conventional system properly uses the 'two different tone signals' to switch into the transceiver communication, after establishing a communication, and the system uses the tone signals during the communication. Thus, the conventional system involves an inconvenience such that the communication
10 has to be disconnected temporarily and a second communication has to be established. However, since there does not occur such inconveniences in the present invention, it is possible to shorten the time until entering a conversation on the transceiver communication.

15 In a remote area where a public telephone network is not available, the system according to the embodiment of this invention can be restricted. There are conceivably quite a few demands for this system in the areas where public telephone networks are available. It is also possible to change the
20 setting in advance in the areas where public telephone networks are available. In that case, the present invention allows the transceiver to be used with ease in a remote place from the cell station, which will not conceivably impair the effectiveness of the invention.

setting in advance in the areas where public telephone networks are available. In that case, the present invention allows using the transceiver to be used with ease in a remote place from the cell station, which will not conceivably impair the effectiveness of the invention.